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Noise reduction prediction of Ariane 5 fairing with acoustic protection made of porous-elastic material

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ESI Group (Formerly STRACO) has been involved during last two decades in the numerical prediction of noise reduction index of ARIANE 5 fairing. During the 90's, STRACO developed an axi-symmetric, boundary element model of the fairing where the fairing protection made of distributed Helmholtz Resonator is modeled by equivalent local impedance. Recently, the fairing acoustic protection has been replaced by a foam-made insulator. Such porous materials are widely used by transportation industries to improve the payload acoustic comfort. In collaboration with automotive industry, ESI group developed RAYON-VTM, a powerful tool allowing the predicting of fully trimmed vehicle vibroacoustic response up to 500 Hz. RAYON VTM model the porous-elastic material using a 3D Finite Element (PEM), based on the Modified-Biot-Equations. This new module of RAYON software has been applied to predict the vibroacoustic response of the ARIANE 5 fairing allowing a detailed modeling of the acoustic protection. A fully 3-D model of the fairing has been developed. The results show the influence of intrinsic modeling of the porous-elastic protection as well as the influence of non-axi-symmetric details usually neglected in the axi-symmetric approach.